

Some Biometrical Observations on the Common Rats of Bombay

BY

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The study of rats in relation to plague epidemiology has been made for the last many years^{1,2}. Bombay rats have been studied in the past by the Indian Plague Commission and other workers. Recently, it has been observed in Bombay that the erstwhile carriers of plague, namely *Rattus rattus* and *Rattus norvegicus*, are becoming immune to plague while the Lesser Bandicoot or Indian Mole-Rat *bandicota bengalensis*, normally an inhabitant of fields, is becoming more susceptible to the disease. Some significant changes in the percentages of the different species of Bombay rats collected are also noticeable in recent years.

Considering the present state of affairs an attempt was made in 1954 and 1955 to study the common Bombay rats with special reference to certain biometrical measurements, breeding seasons, and some morphological characters which would help in increasing existing knowledge regarding the general classification of these rodents of Bombay.

A large number of rats (both alive and dead) are received at the Haffkine Institute daily from different parts of the City for examination. From this central pool of rats about a dozen (whenever available) were taken every day for the present investigation. The rats were etherised before measuring. Body measurements were taken with a measuring tape. Rings on the tail and vibrissae were actually counted.

For studying the pads and the rings on the paws the specimens were placed under the binocular microscope. Actual counting of hairs was done for the density of fur in the particular measured area. The number of rats used are given in Table I.

Each form of rat in Bombay has its own characteristic percentage in the rat population. During recent years, a definite shift has been observed in the percentage of the different forms. Table II gives the percentage of different rats brought to this Institute during different years. It will be seen that the percentage of *R. norvegicus* is more or less constant, while that of *R. rattus* shows a definite decrease during

¹ Hossack, W.C. (1907) : An account of Rats of Calcutta. *Mem. Ind. Mus.* 1 : 1-80.

² Reports of Haffkine Institute, 1947 to 1955.

TABLE I:
SHOWING THE NUMBER OF RATS USED FOR BIOMETRICAL OBSERVATIONS DURING THE PERIOD OF STUDY

	No. of rats received at the Institute both alive and dead		No. of rats measured		Sex-wise distribution of the rats used for biometrical observations					
	1954		1955		1954		1955		Total	
	1954	1955	1954	1955	Male	Female	Male	Female	Male	Female
<i>R. rattus</i>	2,31,861	2,40,765	898	931	414	484	471	460	885	944
<i>R. norvegicus</i>	1,67,450	1,80,135	500	617	254	246	228	289	582	535
<i>B. bengalensis</i>	3,56,433	4,51,446	624	736	274	350	423	313	697	663
<i>B. indica</i>	8,139	7,551	18	24	12	6	13	11	25	17
<i>M. musculus</i>	52,568	44,709	13	27	9	4	12	15	21	19
<i>S. murinus</i>	1,22,367	1,04,887	81	98	41	40	52	44	93	84

TABLE II :

SHOWING THE PERCENTAGES OF DIFFERENT RATS RECORDED IN THE RAT CATCHES BROUGHT TO THE INSTITUTE

Year	<i>R. rattus</i>	<i>R. norvegicus</i>	<i>B. bengalensis</i>	<i>B. indica</i>	<i>M. musculus</i>	<i>S. murinus</i>
1947	38.0	16.2	34.7	0.2	8.0	2.9
1948	36.6	18.8	31.8	0.4	8.5	3.9
1949	23.3	20.0	42.2	0.4	9.1	5.0
1950	23.9	17.6	39.3	0.7	11.0	7.5
1951	21.1	16.5	36.7	0.8	13.1	11.8
1952	22.6	17.7	38.1	1.0	13.0	7.6
1953	22.3	16.7	39.9	1.0	14.3	5.8
1954	24.7	17.8	38.0	0.9	13.0	5.6
1955	23.4	17.5	43.9	0.7	10.2	4.3

recent years¹. *Bandicota bengalensis* shows a greater increase as compared with *R. rattus*. This form, originally to be found in fields, is now coming nearer human habitation. The percentage of *B. indica* is very low in the total population. *Mus musculus* and *Suncus murinus* show a slightly increased percentage in recent years.

Table III summarises the observations made on the weight, length of body, length of tail, head, ear, number and characteristics of rings on tail, number of vibrissae, nature of fur on the body, number of mammary glands, structure of paws, droppings, and other characteristics. It is intended to serve the general public as a handy guide for identifying Bombay rats; therefore, details are omitted. Biometrical observations help in giving definite information as regards the measurements of different body parts in the various species. Study of fur is important from the point of host specificity. Ectoparasites, especially fleas, like a fur of thick density and of a texture that will suit their movements on the host's body. *R. rattus*, which carries the largest number of fleas, has fur of thick density and of smooth texture. But the fur is comparatively thin in the case of *R. norvegicus* which carries a smaller number of fleas. Fur of *B. bengalensis* is of harsh texture and thick density; *B. bengalensis* carries more *Xenopsylla astia* than *X. cheopis*.² It appears that *X. astia* likes fur of thick density and harsh texture while *X. cheopis*

¹ Report of Haffkine Institute, 1947 to 1955.

² Deoras, P. J. and Tonpi, K. V. (1956) : *The Journal of Bombay University* 25 (3) : 13.

TABLE III
SOME DIAGNOSTIC CHARACTERS FOR THE IDENTIFICATION OF THE COMMON RATS OF BOMBAY

No.	Character	<i>R. rattus</i>	<i>R. norvegicus</i>	<i>B. bengalensis</i>	<i>B. indica</i>	<i>M. musculus</i>	<i>S. murinus</i>
1.	Common name.	House Rat	Brown Rat	Indian Mole-Rat	Bandicoot Rat	House Mouse	Grey Musk Shrew
2.	Habit	In and near houses	Away from houses ; in drains	In fields and in open spaces	Only in fields	In houses near man	Insectivorous, near man
3.	Body	Medium slender animal	More fleshy than <i>R. rattus</i>	Heavy build, piglike face	Very big, ferocious	Looks like a miniature <i>R. rattus</i>	Small, slender, with short snout
4.	Weight*	120-125 gm.	142-146 gm.	234-237 gm.	370-414 gm.	23-26 gm.	60-65 gm.
5.	Total Length	35-38 cm.	35-41 cm.	36-41 cm.	38-45 cm.	15-20 cm.	20-24 cm.
6.	Length of Tail	20-22 cm. Always greater than length of head and body together, uniformly tapering from base to tip.	17-19 cm. Always less than head and body together. Not uniform and tapering. Tuft of hairs at tip.	18-20 cm. Less than or sometimes equal to length of head and body together.	19-23 cm. Equal to length of head and body. Not uniformly tapering.	6-7 cm. Less than length of head and body.	6-8 cm. Less than length of head and body.

* Females are heavier than males.

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7.	Head and snout ..	3.5-4 cm. Short, long and sharp	4-4.2 cm. Wide and sharp	4.5-4.7 cm. Short, stumpy, pig-like	5-5.4 cm. Broad, slightly longish	2-2.3 cm. Small in size	3-3.4 cm. Less broad. Pointed snout
8.	Rings on tail ..	225-240 rings, well marked	165-170 rings, faintly marked	160-170 rings, clearly seen. Scaly tail	230-240 rings, not clear	35-40 rings, not very clear.	No rings. Small, very fine hairs.
9.	Ears ..	2.4-2.5 cm. Translucent. No hairs. Ears reach the eye when stretched forward	2.0-2.2 cm. Opaque and thick. Ears do not reach the eyes	2.5-2.6 cm. Thick and opaque	2.5-2.8 cm. Short and opaque. Ears do not reach the eyes.	1.1-1.3 cm. Small and translucent	0.5 cm. Very small and of a rounded shape like a human ear
10.	Mammary glands ..	5 pairs, 2 pectoral, 3 inguinal	6 pairs, 2 pectoral, 4 inguinal	9 pairs, 2 pectoral, 7 inguinal	10 pairs, 3 pectoral, 7 inguinal	4 pairs, 1 pectoral, 3 inguinal	3 pairs, 0 pectoral, 3 inguinal

11.	Fur ..	Soft blackish brown	Soft, brownish, white on belly	Thick, round, blackish brown, prominent spines present	Very thick, coarse, dark brown, long spines	Fine short hairs, smooth in texture	Smooth grey, faint on belly
	Between fore legs ..	379.8 per sq. cm.	348.2 per sq. cm.	412.5 per sq. cm.	436 per sq. cm.	159.1 per sq. cm.	127.7 per sq. cm.
	Between hind legs ..	343.3 do.	332.6 do.	396.2 do.	420.5 do.	141.2 do.	113.3 do.
	Anterior dorsal ..	388.4 do.	367.6 do.	431.3 do.	443.5 do.	172.7 do.	146.3 do.
	Posterior dorsal ..	366.3 do.	367.6 do.	406.4 do.	415.1 do.	146.3 do.	124.6 do.
12.	No. of pads on forepaws ..	5 on tips of digits, 3 interdigital, 1 hypothenar, 1 thenar	5 on tips of digits, 3 interdigital, 1 hypothenar, 1 thenar	5 on tips of digits, 3 interdigital, 1 hypothenar, 1 thenar	5 on tips of digits, 3 interdigital, 1 hypothenar, 1 thenar	5 on tips of digits, 3 interdigital, 1 hypothenar, 1 thenar	5 on tips of digits, 4 interdigital, 1 hypothenar, 1 thenar
13.	Shape and average weight of faecal pellets ..	Scattered, sausage-shaped, 0.0521 gm.	In groups, spindle-shaped, 0.0808 gm.	Scattered, oval, 0.0417 gm.	Scattered, big spindles, 0.064 gm.	Fine spindles, 0.0212 gm.	Scattered, small, longish, 0.0258 gm.
14.	Noise ..	<i>Chew-Chew</i>	Squeaks	Grunts	<i>Khur-Khur</i>	<i>Chur-chur</i>	Long note <i>sheer-sheer</i>
15.	The month when more pregnant females were received.	June to August	July to August	July to August	—	—	—

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7.	Head and snout ..	3.5-4 cm. Short, long and sharp	4-4.2 cm. Wide and sharp	4.5-4.7 cm. Short, stumpy, pig-like	5-5.4 cm. Broad, slightly longish	2-2.3 cm. Small in size	3-3.4 cm. Less broad. Pointed snout
8.	Rings on tail ..	225-240 rings, well marked	165-170 rings, faintly marked	160-170 rings, clearly seen. Scaly tail	230-240 rings, not clear	35-40 rings, not very clear.	No rings. Small, very fine hairs.
9.	Ears ..	2.4-2.5 cm. Translucent. No hairs. Ears reach the eye when stretched forward	2.0-2.2 cm. Opaque and thick. Ears do not reach the eyes	2.5-2.6 cm. Thick and opaque	2.5-2.8 cm. Short and opaque. Ears do not reach the eyes.	1.1-1.3 cm. Small and translucent	0.5 cm. Very small and of a rounded shape like a human ear
10.	Mammary glands ..	5 pairs, 2 pectoral, 3 inguinal	6 pairs, 2 pectoral, 4 inguinal	9 pairs, 2 pectoral, 7 inguinal	10 pairs, 3 pectoral, 7 inguinal	4 pairs, 1 pectoral, 3 inguinal	3 pairs, 0 pectoral, 3 inguinal

11.	Fur ..	Soft blackish brown	Soft, brownish, white on belly	Thick, round, blackish brown, prominent spines present	Very thick, coarse, dark brown, long spines	Fine short hairs, smooth in texture	Smooth grey, faint on belly
	Between fore legs ..	379.8 per sq. cm.	348.2 per sq. cm.	412.5 per sq. cm.	436 per sq. cm.	159.1 per sq. cm.	127.7 per sq. cm.
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12.	No. of pads on forepaws ..	5 on tips of digits, 3 interdigital, 1 hypothenar, 1 thenar	5 on tips of digits, 3 interdigital, 1 hypothenar, 1 thenar	5 on tips of digits, 3 interdigital, 1 hypothenar, 1 thenar	5 on tips of digits, 3 interdigital, 1 hypothenar, 1 thenar	5 on tips of digits, 3 interdigital, 1 hypothenar, 1 thenar	5 on tips of digits, 4 interdigital, 1 hypothenar, 1 thenar
13.	Shape and average weight of faecal pellets ..	Scattered, sausage-shaped, 0.0521 gm.	In groups, spindle-shaped, 0.0808 gm.	Scattered, oval, 0.0417 gm.	Scattered, big spindles, 0.064 gm.	Fine spindles, 0.0212 gm.	Scattered, small, longish, 0.0258 gm.
14.	Noise ..	Chew-Chew	Squeaks	Grunts	Khur-Khur	Chur-chur	Long note sheer-sheer
15.	The month when more pregnant females were received.	June to August	July to August	July to August	—	—	—

TABLE IV
FREQUENCY DISTRIBUTION OF THE VIBRISSAE OF THE RATS EXAMINED

Species	<i>R. rattus</i>		<i>R. norvegicus</i>		<i>B. bengalensis</i>		<i>B. indica</i>		<i>M. musculus</i>		<i>S. murinus</i>	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Average of	442	472	241	267	348	331	12	15	10	12	46	42
No. of Vibrissae	48.2 ± 6.0	48.0 ± 6.1	47.4 ± 5.7	47.4 ± 6.2	49.3 ± 6.3	49.6 ± 5.7	49	48.8	26.7	26.3	26.3	26.4

TABLE V
 AVERAGE NO. OF EMBRYOS PER LITTER
 (Average of 45 rats)

Species	No. of Embryos (Average)	No. of Embryos (Maximum)
<i>R. rattus</i>	6	8
<i>R. norvegicus</i>	6	8
<i>B. bengalensis</i>	8	10
<i>B. indica</i>	10	12
<i>M. musculus</i>	2	4
<i>S. murinus</i>	2	4

prefers fur of thick density and smooth texture such as is found on *R. rattus*. Fleas are seen more in the region between the limbs. It may be that in this region they can conceal themselves more effectively, and or the skin is more suitable for making an incision.

Burrowing habits differ with different rats. *B. bengalensis* and *B. indica* are the most important burrowers. The House Rat, *R. rattus*, if left in an enclosed place, tries all ways and means of escape and, if it fails, then only does it take to burrowing. Field rats, or bandicoots on the other hand, start burrowing as soon as they are let loose. Burrows made by them are generally 'W' shaped. The breeding season varies from place to place, depending upon the climate. Bombay rats breed more during the months July to September. A proper study of the habits of rats tells us when they breed at their maximum during the year, knowledge that helps in drawing up a control programme.

The following are some general observations on the different rats found in the local collections.*

Rattus rattus (Linnaeus) : The House Rat

A very common rodent in Bombay. A clean, neat-living creature. It is a small and slender animal of elegant build. Muzzle sharp; ears almost naked and translucent and so large as to cover the eyes completely when turned forwards; tail slender, often considerably longer than the head and body together. Head more long than broad. Fur brownish, paler on the belly; spines not present in the fur.

* The nomenclature is according to Ellerman, J. R. and Morrison-Scott, T.C.S. (1951); CHECKLIST OF PALAEARCTIC AND INDIAN MAMMALS 1758 to 1946 Brit. Mus. (Nat. Hist.)